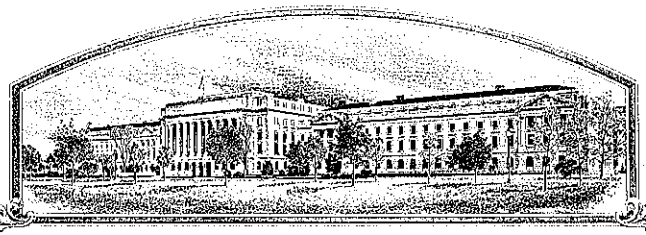

No. 9500233

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

North Dakota State University
North Dakota Agricultural Experiment Station

Whereas, THERE HAS BEEN PRESENTED TO THE

Secretary of Agriculture

AN APPLICATION REQUESTING A CERTIFICATE OF PROTECTION FOR AN ALLEGED DISTINCT VARIETY OF SEXUALLY REPRODUCED, OR TUBER PROPAGATED, PLANT, THE NAME AND DESCRIPTION OF WHICH ARE CONTAINED IN THE APPLICATION AND EXHIBITS, A COPY OF WHICH IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED HAVE BEEN COMPLIED WITH, AND THE TITLE THERETO IS, FROM THE RECORDS OF THE PLANT VARIETY PROTECTION OFFICE, IN THE APPLICANT(S) INDICATED IN THE SAID COPY, AND WHEREAS, UPON DUE EXAMINATION MADE, THE SAID APPLICANT(S) IS (ARE) ADJUDGED TO BE ENTITLED TO A CERTIFICATE OF PLANT VARIETY PROTECTION UNDER THE LAW.

NOW, THEREFORE, THIS CERTIFICATE OF PLANT VARIETY PROTECTION IS TO GRANT UNTO THE SAID APPLICANT(S) AND THE SUCCESSORS, HEIRS OR ASSIGNS OF THE SAID APPLICANT(S) FOR THE TERM OF TWENTY YEARS FROM THE DATE OF THIS GRANT, SUBJECT TO THE PAYMENT OF THE REQUIRED FEES AND PERIODIC REPLENISHMENT OF VIABLE BASIC SEED OF THE VARIETY IN A PUBLIC REPOSITORY AS PROVIDED BY LAW, THE RIGHT TO EXCLUDE OTHERS FROM SELLING THE VARIETY, OR OFFERING IT FOR SALE, OR REPRODUCING IT, OR IMPORTING IT, OR EXPORTING IT, OR CONDITIONING IT FOR PROPAGATION, OR STOCKING IT FOR ANY OF THE ABOVE PURPOSES, OR USING IT IN PRODUCING A HYBRID OR DIFFERENT VARIETY THEREFROM, TO THE EXTENT PROVIDED BY THE PLANT VARIETY PROTECTION ACT. IN THE UNITED STATES SEED OF THIS VARIETY (1) SHALL BE SOLD BY VARIETY NAME ONLY AS A CLASS OF CERTIFIED SEED, (2) SHALL CONFORM TO THE NUMBER OF GENERATIONS SPECIFIED BY THE OWNER OF THE RIGHTS. (84 STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

WHEAT

'Kulm'

In Testimony Whereof, I have hereunto set my hand and caused the seal of the Plant Variety Protection Office to be affixed at the City of Washington, D.C. this thirtieth day of September in the year of our Lord one thousand nine hundred and ninety-six.

Attest:

Marsha A. Stanis
Commissioner
Plant Variety Protection Office
Agricultural Marketing Service

Dan Glickman
Secretary of Agriculture

REPRODUCE LOCALLY. *Include form number and date on all reproductions.*

FORM APPROVED - OMB NO. 0581-0055

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE DIVISION - PLANT VARIETY PROTECTION OFFICE

APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE

(Instructions and information collection burden statement on reverse)

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C. 552a).

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF APPLICANT(S) *(as it is to appear on the Certificate)*

North Dakota State University
North Dakota Agricultural Experiment Station

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NUMBER

ND 671

3. VARIETY NAME

KULM

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP Code, and Country)*

Box 5790
North Dakota State University
Fargo, ND 58105-5790

5. TELEPHONE *(include area code)*

701-231-7033

6. FAX *(include area code)*

701-231-8098

FOR OFFICIAL USE ONLY

PVPO NUMBER: 9500233

FILING DATE: 4/25/95

FEE RECEIVED
FILING AND EXAMINATION FEE: $ 2450.00
DATE: 5/30/95
CERTIFICATION FEE: $ 340.00
DATE: May 13 1996

7. GENUS AND SPECIES NAME

Triticum aestivum L.

8. FAMILY NAME *(Botanical)*

Gramineae

9. CROP KIND NAME *(Common name)*

10. IF THE APPLICANT NAMED IS NOT A "PERSON", GIVE FORM OF ORGANIZATION *(corporation, partnership, association, etc.) (Common name)*

Educational Institution

11. IF INCORPORATED, GIVE STATE OF INCORPORATION

N/A

12. DATE OF INCORPORATION

N/A

13. NAME AND ADDRESS OF APPLICANT REPRESENTATIVE(S), IF ANY, TO SERVE IN THIS APPLICATION AND RECEIVE ALL PAPERS

Richard C. Frohberg
Department of Plant Sciences
NDSU
Fargo, ND 58105

14. TELEPHONE *(include area code)*

701-231-8143

15. FAX *(include area code)*

701-231-8474

16. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED *(Follow instructions on reverse)*

a. ☒ Exhibit A. Origin and Breeding History of the Variety
b. ☒ Exhibit B. Statement of Distinctness
c. ☒ Exhibit C. Objective Description of the Variety
d. ☒ Exhibit D. Additional Description of the Variety
e. ☒ Exhibit E. Statement of the Basis of the Applicant's Ownership
f. ☒ Voucher Sample *(2,500 viable untreated seeds or, for tuber propagated varieties verification that tissue culture will be deposited and maintained in a public repository)*
g. ☒ Filing and Examination Fee ($2,450), made payable to "Treasurer of the United States" *(Mail to PVPO)*

17. DOES THE APPLICANT SPECIFY THAT SEED OF THIS VARIETY BE SOLD BY VARIETY NAME ONLY, AS A CLASS OF CERTIFIED SEED? *(See Section 83(a) of the Plant Variety Protection Act)?*

☒ YES *(If "yes," answer items 18 and 19 below)* ☐ NO *(If "no," go to item 20)*

18. DOES THE APPLICANT SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF GENERATIONS?

☒ YES ☐ NO

19. IF "YES" TO ITEM 18, WHICH CLASSES OF PRODUCTION BEYOND BREEDER SEED?

☒ FOUNDATION ☒ REGISTERED ☒ CERTIFIED

20. HAS THE VARIETY OR A HYBRID PRODUCED FROM THE VARIETY BEEN RELEASED, USED, OFFERED FOR SALE, OR MARKETED IN THE U.S. OR OTHER COUNTRIES?

☒ YES *(If "yes," give names of countries and dates)* ☐ NO USA 17 March 94 - released
USA 15 December 94 - offered for sale

21. The applicant(s) declare that a viable sample of basic seed of the variety will be furnished with application and will be replenished upon request in accordance with such regulations as may be applicable, or for a tuber propagated variety a tissue culture will be deposited in a public repository and maintained for the duration of the certificate.

The undersigned applicant(s) is(are) the owner(s) of this sexually reproduced or tuber propagated plant variety, and believe(s) that the variety is new, distinct, uniform, and stable as required in Section 41, and is entitled to protection under the provisions of Section 42 of the Plant Variety Protection Act.

Applicant(s) is(are) informed that false representation herein can jeopardize protection and result in penalties.

SIGNATURE OF APPLICANT *(Owner(s))*		SIGNATURE OF APPLICANT *(Owner(s))*	
Richard C Frohberg		Robert Todd R. Craig Schnell	
NAME *(Please print or type)*		NAME *(Please print or type)*	
Richard C. Frohberg		Robert Todd - NDAES R. Craig Schnell - NDSU	
CAPACITY OR TITLE	DATE	CAPACITY OR TITLE	DATE
HRS Wheat Breeder		Todd - Director AES Schnell-Dean, Graduate Studies & Research	

SD-470 (04-95) *(Previous editions are to be destroyed)*

(See reverse for instructions and information collection burden statement)

EXHIBIT A - ORIGIN AND BREEDING HISTORY

'KULM'

Fall 1984	Original cross made at North Dakota State University (NDSU) greenhouse. Cross number is 85108. Pedigree - Stoa sib/ND620 ND620 = MN7378//ND517*4/SD69103
Spring 1985	F1 plants, NDSU greenhouse.
Summer 1985	F2 spaced plants, NDSU research land.
Winter 1985-86	F3 head row, winter nursery - Weslaco, TX.
Summer 1986	F4 head row, NDSU research land.
Winter 1986-87	F5 head row, winter nursery - Weslaco, TX.
Summer 1987	F6 preliminary yield trial, 2 locations, NDSU research land.
Summer 1988	F7 advanced yield trial, 3 locations, NDSU research land.
Winter 1988-89	F8 head row, winter nursery - Weslaco, TX.
Summer 1989	F9 preliminary yield trial, 2 locations, NDSU research land.
Summer 1990	F10 elite yield trial, 4 locations, NDSU research land. Seed increase (117 lbs.) Prosper, ND.
Summer 1991-1993	North Dakota HRS wheat variety trial, 7 locations each year. Uniform Regional HRS Wheat Nursery, about 20 locations each year, Upper Midwest/U.S.A. Experimental line designation - ND671.
Summer 1992-1993	Spring Wheat Quality Advisory Council test.
Summer 1991-1993	Seed increase in North Dakota by NDSU Seedstocks Project.
March 17, 1994	ND671 released as a named cultivar, Kulm. The unselected progeny of a single F7 plant.

Observations indicate Kulm is uniform and stable within commercially acceptable limited for all traits as described in Exhibit C. Variants (taller plants, 5-15 cm) occurrence at a frequency of 7/10,000.

9500233

NDSU

DEPARTMENT OF PLANT SCIENCES
RESEARCH–TEACHING–EXTENSION

North Dakota State University
Loftsgard Hall
P.O. Box 5051
Fargo, North Dakota
58105-5051 USA

Tel.701.231.7971
Fax701.231.8474

December 28, 1995

Mr. Alan A. Atchley
Plant Variety Protection Office
NAL Building, Room 500
10301 Baltimore Blvd.
Beltsville, MD 20705

Biotechnology
Breeding
Forestry
Genetics
Horticulture
Physiology
Production
Weed Science

SUBJECT: PVP Application No. 9500233, Wheat 'Kulm'

Dear Mr. Atchley:

Following is the information that you requested (letter 30 June 1995) so that the examination of 'Kulm' wheat may be concluded:

Exhibit A

Stability and uniformity of Kulm were observed 1988-1989 to 1993 for six generations (F_8 - F_{13}). Kulm is the increase of the bulked progeny of a F_7 plant.

Selection criteria for the breeding of Kulm wheat were highly heritable traits (i.e., plant height, maturity, disease resistance) in the early segregating generations, F_2 - F_5. Beginning in the F_6 generation, selection criteria also included lodging resistance, shattering resistance, test weight, grain yield, and bread making characters (grain protein, milling extraction, dough mixing, loaf volume, etc.). Data were obtained from multiple locations and over years to evaluate and identify the experimental line ND671 that was named Kulm. Overall, the selection criteria were a combination of traits used to identify a superior hard red spring wheat genotype adapted to North Dakota wheat production and having acceptable (compared to check cultivars) milling and bread making properties for domestic and export markets.

The Variety Release Committee of the North Dakota Agricultural Experiment Station (NDAES) recommended to Dr. Robert Todd, Director, NDAES, that the experimental wheat line ND671 be named Kulm and released as a cultivar. Dr. Todd announced this release through public media on March 17, 1994. Seed of Kulm was distributed by the NDAES through the North Dakota Crop Improvement county groups to experienced seed producers for seed multiplication during the growing season of 1994. These producers were under contract to the Seedstocks Project, Department of Plant Sciences, NDAES, North Dakota State University for the Kulm seed produced. On December 15, 1994, these contracted seed producers were released from their contract and Kulm seed was then available and offered for sale in the U.S.A.

Exhibit B

Since Table 4 of the supporting data is not adequate to support the novelty claim of items 1. and 2. in the novelty statement for Kulm wheat, then please retain only item 3. "Kulm is photoperiod insensitive (daylength neutral). Stoa is photoperiod sensitive." This novelty claim is based on observations (of a qualitatively inherited trait) in an off-season winter nursery (Table 8 of supporting data).

Exhibit C - Statement of the basis of applicant's ownership (revised as follows, December 1995)

sphalm: C RMA 3 Jan 1996

'Kulm', the hard red spring wheat cultivar for which Plant Variety Protection is hereby sought, was originated and developed by Dr. Richard C. Frohberg, an employee of the North Dakota Agricultural Experiment Station, North Dakota State University. As provided by the State of North Dakota Century Code, Richard C. Frohberg retains those rights to any invention, discovery, or development made as an employee of North Dakota State University, to include the origination and development of Kulm wheat. North Dakota State University is assigned those rights to Kulm wheat which are not retained by Richard C. Frohberg, the breeder of Kulm wheat. In accordance with North Dakota law, the administration of such inventions and related rights at North Dakota State University has been assigned to the NDSU Research Foundation.

Superseded per letter, AAA 22 Jul 1996

Differences between Kulm and 'Butte 86'

Kulm differs from Butte 86 for seedling infection type to two isolates of wheat stem rust (Table 9).

Kulm differs from Butte 86 for gel electrophoresis pattern (esterase) shown in photographic print (Figure 1). Lanes 1 and 2 are Butte 86 and lanes 3 and 4 are Kulm. An arrow indicates the band difference.

Kulm differs from Butte 86 for gel electrophoresis pattern (peroxidase) shown in photographic print (Figure 2). Lanes 1 and 2 are Butte 86 and lanes 3 and 4 are Kulm. An arrow indicates the band difference.

This information should provide facts and data for the examination of Kulm wheat.

Sincerely,

Richard C Frohberg

Richard C. Frohberg
Professor

RCF:lh
Attach.: Table 9
Figures 1 and 2

EXHIBIT B - NOVELTY STATEMENT

To my knowledge Kulm most nearly resembles Stoa. Differences include, but are not necessarily restricted to, the following:

~~1. Kulm is 3-4 days earlier heading.~~

~~2. Kulm is 2 lbs/bushel heavier test weight.~~

[Deleted per Letter AKA 3 Jan 1996]

3. Kulm is photoperiod insensitive (daylength neutral). Stoa is photoperiod sensitive.

FORM APPROVED: OMB NO. 0581-0055

EXHIBIT C
(Wheat)

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
COMMODITIES SCIENTIFIC SUPPORT DIVISION
BELTSVILLE, MARYLAND 20705

OBJECTIVE DESCRIPTION OF VARIETY
WHEAT (*TRITICUM SPP.*)

INSTRUCTIONS: *See Reverse.*

NAME OF APPLICANT(S)
Agricultural Experiment Station
North Dakota State University

ADDRESS (*Street and No. or R.F.D. No., City, State, and ZIP Code*)
315 Morrill Hall
P.O. Box 3435
North Dakota State Univeristy
Fargo, ND 58105

FOR OFFICIAL USE ONLY

PVPO NUMBER
9500233

VARIETY NAME OR TEMPORARY DESIGNATION

Place the appropriate number that describes the varietal character of this variety in the boxes below.
Place a zero in first box (e.g. 0 8 9 or 0 9) when number is either 99 or less or 9 or less.

1. KIND:
[1] 1 = COMMON 2 = DURUM 3 = EMMER 4 = SPELT 5 = POLISH 6 = POULARD 7 = CLUB

2. TYPE:
[1] 1 = SPRING 2 = WINTER 3 = OTHER (*Specify*) _____ [2] 1 = SOFT 2 = HARD 3 = OTHER (*Specify*) _____

[2] 1 = WHITE 2 = RED 3 = OTHER (*Specify*) _____

3. SEASON - NUMBER OF DAYS FROM EMERGENCE TO:
[0 5 3] FIRST FLOWERING [0 5 6] LAST FLOWERING

4. MATURITY (*50% Flowering*):
[0 5] NO. OF DAYS *EARLIER* THAN ..... [3] 1 = ARTHUR 2 = SCOUT 3 = CHRIS
[ ] NO. OF DAYS *LATER* THAN ..... [ ] 4 = LEMHI 5 = NUGAINES 6 = LEEDS

5. PLANT HEIGHT (*From soil level to top of head*):
[0 9 0] CM. HIGH
[ ] CM. TALLER THAN ..... [ ]
[0 8] CM. SHORTER THAN ..... [3] 1 = ARTHUR 2 = SCOUT 3 = CHRIS 4 = LEMHI 5 = NUGAINES 6 = LEEDS

6. PLANT COLOR AT BOOTING (*See reverse*):
[3] 1 = YELLOW GREEN 2 = GREEN 3 = BLUE GREEN

7. ANTHER COLOR:
[1] 1 = YELLOW 2 = PURPLE

8. STEM:
[1] Anthocyanin: 1 = ABSENT 2 = PRESENT
[2] Hairiness of last internode of rachis: 1 = ABSENT 2 = PRESENT
[0 4] NO. OF NODES (*Originating from node above ground*)
[1] Waxy bloom: 1 = ABSENT 2 = PRESENT
[1] Internodes: 1 = HOLLOW 2 = SOLID
[2 4] CM. INTERNODE LENGTH BETWEEN FLAG LEAF AND LEAF BELOW

9. AURICLES:
[1] Anthocyanin: 1 = ABSENT 2 = PRESENT
[1] Hairiness: 1 = ABSENT 2 = PRESENT

10. LEAF:
[2] Flag leaf at booting stage: 1 = ERECT 2 = RECURVED 3 = OTHER (*Specify*): _____
[2] Flag leaf: 1 = NOT TWISTED 2 = TWISTED
[1] Hairs of first leaf sheath: 1 = ABSENT 2 = PRESENT
[2] Waxy bloom of flag leaf sheath: 1 = ABSENT 2 = PRESENT
[1 0] MM. LEAF WIDTH (*First leaf below flag leaf*)
[2 7] CM. LEAF LENGTH (*First leaf below flag leaf*):

FORM LMGS 470-6 (6-82) (Formerly Form LPGS 470-6 (3-79), which may be used)

9500233

11. HEAD:

[1] Density: 1 = LAX 2 = DENSE

[1] Shape: 1 = TAPERING 2 = STRAP 3 = CLAVATE 4 = OTHER (Specify) _____

[4] Awnedness: 1 = AWNLESS 2 = APICALLY AWNLETED 3 = AWNLETED 4 = AWNED

[2] Color at maturity: 1 = WHITE 2 = YELLOW 3 = PINK 4 = RED 5 = BROWN 6 = BLACK 7 = OTHER (Specify): _____

[0][6] CM. LENGTH

[1][2] MM. WIDTH

12. GLUMES AT MATURITY:

[1] Length: 1 = SHORT (CA. 7 mm.) 2 = MEDIUM (CA. 8 mm.) 3 = LONG (CA. 9 mm.)

[2] Width: 1 = NARROW (CA. 3 mm.) 2 = MEDIUM (CA. 3.5 mm.) 3 = WIDE (CA. 4 mm.)

[5] Shoulder shape: 1 = WANTING 2 = OBLIQUE 3 = ROUNDED 4 = SQUARE 5 = ELEVATED 6 = APICULATE

[3] Beak: 1 = OBTUSE 2 = ACUTE 3 = ACUMINATE

13. COLEOPTILE COLOR:

[1] 1 = WHITE 2 = RED 3 = PURPLE

14. SEEDLING ANTHOCYANIN:

[1] 1 = ABSENT 2 = PRESENT

15. JUVENILE PLANT GROWTH HABIT:

[2] 1 = PROSTRATE 2 = SEMI-ERECT 3 = ERECT

16. SEED:

[2] Shape: 1 = OVATE 2 = OVAL 3 = ELLIPTICAL

[2] Cheek: 1 = ROUNDED 2 = ANGULAR

[1] Brush: 1 = SHORT 2 = MEDIUM 3 = LONG

[1] Brush: 1 = NOT COLLARED 2 = COLLARED

[4] Phenol reaction (See instructions): 1 = IVORY 2 = FAWN 3 = LT. BROWN 4 = BROWN 5 = BLACK

[3] Color: 1 = WHITE 2 = AMBER 3 = RED 4 = PURPLE 5 = OTHER (Specify) _____

[0][5] MM. LENGTH

[0][3] MM. WIDTH

[3][2] GM. PER 1000 SEEDS

17. SEED CREASE:

[2] Width: 1 = 60% OR LESS OF KERNEL 'WINOKA' 2 = 80% OR LESS OF KERNEL 'CHRIS' 3 = NEARLY AS WIDE AS KERNEL 'LEMHI'

[2] Depth: 1 = 20% OR LESS OF KERNEL 'SCOUT' 2 = 35% OR LESS OF KERNEL 'CHRIS' 3 = 50% OR LESS OF KERNEL 'LEMHI'

18. DISEASE: (0 = Not Tested, 1 = Susceptible, 2 = Resistant)

[2] STEM RUST (Races) TNMK QCC, QFB QSH, TLM

[2] LEAF RUST (Races) Local

[0] STRIPE RUST (Races) _____

[0] LOOSE SMUT

[0] POWDERY MILDEW

[0] BUNT

[1] OTHER (Specify) Leaf spotting complex

19. INSECT: (0 = Not Tested, 1 = Susceptible, 2 = Resistant)

[1] SAWFLY

[0] APHID (Bydv.)

[0] GREEN BUG

[0] CEREAL LEAF BEETLE

[ ] OTHER (Specify) _____

HESSIAN FLY RACES: [0] GP [0] A [0] B [0] C [0] D [0] E [0] F [0] G

20. INDICATE WHICH VARIETY MOST CLOSELY RESEMBLES THAT SUBMITTED:

CHARACTER	NAME OF VARIETY	CHARACTER	NAME OF VARIETY
Plant tillering	Stoa	Seed size	Grandin
Leaf size	Stoa	Seed shape	Grandin
Leaf color	Stoa	Coleoptile elongation	Stoa
Leaf carriage	Stoa	Seedling pigmentation	Stoa

INSTRUCTIONS

GENERAL: The following publications may be used as a reference aid for the standardization of terms and procedures for completing this form:

(a) L.W. Briggle and L. P. Reitz, 1963, Classification of Triticum Species and Wheat Varieties Grown in the United States, Technical Bulletin 1278, United States Department of Agriculture.

(b) W.E. Walls, 1965, A Standardized Phenol Method for Testing Wheat Seeds for Varietal Purity, contribution No. 28 to the handbook of seed testing prepared by the Association of Official Seed Analysts. (See attachment.)

EXHIBIT D - ADDITIONAL DESCRIPTION OF VARIETY

When Kulm is compared to Stoa it is higher in flour extraction, loaf volume and bake absorption. Kulm is lower than Stoa in wheat and flour protein, and has a shorter bake mix time. The farinogram dough mixing properties are somewhat weaker than Stoa.

When Kulm is compared to Grandin it is higher in wet gluten, loaf volume and has better crumb color. Kulm is lower than Grandin in wheat and flour protein content, lower bake absorption and has a shorter bake mix time. The farinogram classification is the same as Grandin.

Table 1. **Mean grain yield of selected entries in the 1991-1994 hard red spring wheat variety trial at North Dakota Agricultural Research Centers.[†]**

Cultivar	Dickinson	Hettinger	Williston	North Central	Carrington		Langdon	Prosper
					Dryland	Irrigated		
	bu/A							
Conv. ht.								
Stoa	39.9	67.6	48.0	48.5	50.5	46.5	56.4	48.8
Butte 86	37.7	70.3	45.1	46.3	54.1	49.1	52.9	53.0
Amidon	33.6	73.9	49.8	45.9	46.3	42.4	52.8	44.2
Sharp	41.8	67.5	45.9	45.5	52.4	50.6	55.3	46.1
Kulm	44.6	72.7	48.4	45.7	52.0	48.5	52.7	52.8
Semidwarf								
2375	41.0	71.4	51.0	46.8	53.3	53.3	59.5	52.5
Prospect	38.2	70.0	48.3	49.3	49.2	43.4	54.5	38.3
Vance	42.4	69.8	49.9	47.4	44.1	39.2	50.5	40.5
Gus	39.6	72.7	46.9	48.2	46.1	37.3	49.3	39.8
Grandin	42.9	68.8	49.0	47.2	51.4	43.7	53.8	44.7
Bergen	46.5	74.8	53.5	45.3	50.9	42.4	55.1	43.0
2370	37.7	68.1	46.2	44.2	51.4	43.7	57.5	43.4
2371	39.3	75.0	49.4	46.5	46.4	44.6	54.2	39.4
Dalen	26.7	71.7	50.7	47.6	51.4	44.1	51.3	40.7
Krona	47.9	79.5	56.2	48.2	51.9	44.6	54.9	33.2
Norm	42.4	75.2	49.8	46.8	55.5	48.7	52.2	38.2

[†]Dickinson - 1991 yield data only.
Hettinger - 1991-93 yield data.
Prosper - 1991-92 and 1994 yield data.

Table 2. Summary of agronomic performance of selected entries in the 1991-94 hard red spring wheat variety trial at North Dakota Agricultural Research Centers.

Cultivar	Headed (30)‡	Height (30)	Lodging score (14)	Rust† Leaf (1)	Rust† Stem (1)	Leaf disease (17)	Shattering (2)	Test weight (29)	Grain yield (27)
	days	cm	0-9	%	%	%	%	lb/bu	bu/A
Conv. ht.									
Stoa	63	96	1.8	10R-tMR	0	37	1	58.1	51.5
Butte 86	60	88	1.7	15R-5MR	tR	40	Tr	59.4	51.9
Amidon	63	94	1.9	15R-tMR	tR	29	0	58.5	49.5
Sharp	60	86	2.1	10R	0	36	Tr	60.8	51.5
Kulm	60	90	1.2	15R-tMR	0	44	Tr	60.4	52.3
Semidwarf									
2375	62	84	1.8	40R-tMR	5RMR	40	2	59.8	55.2
Prospect	63	83	0.6	30R-tMR	10MSS	42	Tr	57.8	49.9
Vance	65	85	0.9	20R	0	39	Tr	57.0	48.1
Gus	64	87	0.8	20R-5MR	0	34	Tr	57.8	47.6
Grandin	62	85	1.0	20R-tMR	5R	40	Tr	59.1	50.8
Bergen	63	77	0.4	20R-5MR	0	22	Tr	57.6	51.8
2370	62	82	0.6	15R-tMR	tRMR	35	Tr	58.6	50.1
2371	64	82	0.6	20R-tMS	tR	30	1	57.7	50.1
Dalen	62	78	0.6	15R-5MR	0	32	Tr	59.1	49.7
Krona	65	78	0.5	30R	0	29	Tr	56.6	52.3
Norm	63	82	0.7	20R-tMR	0	26	Tr	57.5	51.8

†Rust data - Fargo 1993.
‡Number of tests each trait.

Table 3. Summary of agronomic performance of selected entries in the Uniform Regional Hard Red Spring Wheat Nursery, 1991-93.

Cultivar	Headed (47)‡	Height (51)	Lodging Score (24)	Rust†		Leaf Disease (13)	Test Weight (49)	Grain Yield (52)
				Leaf (1)	Stem (1)			
	days	cm	1-9	%	%	1-9	lb/bu	bu/A
Era	33	81	2.2	30MS-S	0	4.8	55.4	47.3
Stoa	30	94	2.9	10MR-MS	0	5.5	57.5	52.1
Butte 86	27	87	2.8	10MR-MS	5R-MR	5.4	58.9	52.7
Kulm	26	90	2.1	tR-MR	tR	6.6	59.8	52.6

† Data from 1993 rust nursery, USDA-ARS, Cereal Rust Laboratory, St. Paul, MN.

‡ Number of tests each trait.

Table 4. Mean comparisons for heading and test weight of Stoa and Kulm, hard red spring wheat (HRSW) cultivars, tested in experimental trials, 1991-1994.

Trial series/ cultivar	Heading (days)†				Test Weight (lb/bu)			
ND HRSW	**1991**	**1992**	**1993**	**1994**	**1991**	**1992**	**1993**	**1994**
	(8)‡	**(8)**	**(7)**	**(7)**	**(8)**	**(8)**	**(6)**	**(7)**
Stoa	63	63	70	57	59.2	60.1	55.6	57.3
Kulm	59	59	67	54	61.2	62.1	58.6	59.6
LSD .05	1.1	0.9	1.4	1.6	2.0	1.6	2.4	1.8
URN-HRSW	**1991-92**		**1992-93**		**1991-92**		**1992-93**	
	(32)		**(30)**		**(33)**		**(32)**	
Stoa	28		30		58.2		57.8	
Kulm	24		26		60.5		59.8	
LSD .05	0.9		1.2		1.4		2.0	

† Days to heading from seeding dated for ND-HRSW series of trials; days after June 1 for URN-HRSW series of trials.

‡ Number of tests each trait within one year or combination of years.

Table 5. Summary of quality data--analytical and milling--for selected entries in the 1991-1993 hard red spring wheat drill strips trial at North Dakota Agricultural Research Centers.†

CULTIVAR	TEST WT‡	VIT KER	WHT FAL NO	PROTEIN 14% MB WHT	PROTEIN 14% MB FLR	FLR EXT	WET GLU	FLR ASH
	lb/bu	%	Sec	%	%	%	%	%
Stoa	59.0	87	411	14.8	14.2	68.7	40.6	0.39
Butte 86	60.1	81	420	14.9	13.9	68.5	42.4	0.41
Amidon	60.0	87	410	14.6	13.8	68.7	41.7	0.40
Sharp	61.4	74	410	14.7	13.9	69.1	43.1	0.36
Kulm	61.4	80	418	15.0	14.2	69.5	42.6	0.37
2375	60.5	77	431	14.5	13.7	68.6	40.8	0.41
Vance	58.8	77	430	14.5	13.6	69.9	41.5	0.39
Grandin	60.4	83	416	14.9	14.1	69.9	40.1	0.41
Bergen	59.6	67	422	13.9	13.1	71.3	38.4	0.41
2370	59.8	72	406	14.5	13.8	69.7	38.9	0.42
2371	58.8	84	387	14.8	14.1	70.0	41.5	0.41
Dalen	60.7	77	431	14.7	13.4	68.0	40.1	0.42
Norm	59.6	67	416	13.7	12.8	68.9	35.5	0.40

† 7 locations each 1991 and 1992; 6 locations 1993.

‡ Abbreviations: WT = weight; VIT KER = vitreous kernels; WHT FAL NO. = wheat falling number; MB = moisture basis; FLR = flour; FLR EXT = flour extraction; GLU = gluten.

Table 6. Summary of quality data--farinogram--for selected entries in the 1991-1993 hard red spring wheat drill strips trial at North Dakota Agricultural Research Centers.†

CULTIVAR	PEAK TIME	MIXING TOLERANCE	MECHANICAL TOLERANCE INDEX	CLASS
	Minutes	Minutes	Brabender Units	1-8
Stoa	13.3	18.4	22	6.9
Butte 86	9.0	11.1	31	5.0
Amidon	8.2	12.9	31	5.4
Sharp	7.9	11.8	30	5.1
Kulm	11.1	15.3	22	6.5
2375	9.5	14.6	28	5.8
Vance	8.0	11.6	26	5.1
Grandin	10.1	17.0	20	6.4
Bergen	9.1	11.6	29	5.3
2370	9.5	13.3	31	5.7
2371	8.9	13.6	26	5.7
Dalen	8.5	12.5	24	5.6
Norm	12.9	17.0	22	6.5

† 7 locations each 1991 and 1992; 6 locations 1993.

Table 7. Summary of quality data--baking--for selected entries in the 1991-1993 hard red spring wheat drill strips trial at North Dakota Agricultural Research Centers.†

CULTIVARS	ABS	MIX TIME	DO	LOAF VOL	G-T	CB CL	CT CL	SYM
	%	Min	1-10	CC	1-10	1-10	1-10	1-10
Stoa	64.6	1.95	9.9	866	8.1	8.5	10.0	10.0
Butte 86	68.1	1.65	9.9	860	8.2	8.4	10.0	9.6
Amidon	65.4	1.80	9.8	858	8.1	8.2	10.0	9.9
Sharp	65.8	1.45	9.9	829	8.0	8.6	10.0	9.6
Kulm	66.1	1.70	9.9	911	8.2	8.9	10.0	9.8
2375	66.5	1.60	9.8	845	8.1	8.4	10.0	9.9
Vance	63.4	1.35	9.6	801	7.5	7.7	10.0	9.0
Grandin	67.3	2.00	9.8	872	8.1	8.1	10.0	9.9
Bergen	65.8	1.70	9.7	829	8.1	8.2	10.0	9.6
2370	64.3	1.90	10.0	848	8.2	8.7	10.0	9.6
2371	66.0	1.85	9.9	871	8.0	8.4	10.0	9.8
Dalen	67.5	1.80	9.8	843	8.0	7.7	10.0	9.8
Norm	65.1	2.00	9.9	842	8.2	8.5	10.0	9.7

† 7 locations each 1991 and 1992; 6 locations 1993.

‡ Abbreviations: ABS = baking absorption; DO = dough handling; VOL = volume; G-T = grain and texture; CB CL = crumb color; CT CL = crust color; SYM = loaf symmetry.

Table 8. Photoperiod response of Stoa and Kulm hard red spring wheats at a winter nursery location† near Weslaco, TX, 1987 and 1989.

Cultivar	Row No.	Classification‡	Genetic Segregation
Stoa	1987 TX 1	Sensitive	Homogeneous
Kulm	1987 TX421	Insensitive	Homogeneous
Stoa	1989 TX 2	Sensitive	Homogeneous
Kulm	1989 TX 1177	Insensitive	Homogeneous

† Nursery seeded in October, classification observation in April; short day environment, about 12 hour normal daylength.

‡ Qualitatively inherited trait.

Table 9. Seedling infection type of 'Butte 86' and 'Kulm' hard red spring wheats to selected isolates of wheat stem rust (*Puccinia graminis* f. sp. *tritici*) at two termperatures.

Cultivar	Isolate CRL-SHR Greenhouse bench 65 - 70° F	Isolate CRL-LCC Growth chamber 80 - 84° F
Butte 86	1 1⁻ 0; 3 cn–	1 3 cn
Kulm	0; 1⁻ 1	0; 1

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NDSU

DEPARTMENT OF PLANT SCIENCES
RESEARCH–TEACHING–EXTENSION

North Dakota State University
Loftsgard Hall
P.O. Box 5051
Fargo, North Dakota
58105-5051 USA

Tel.701.231.7971
Fax701.231.8474

July 8, 1996

Biotechnology
Breeding
Forestry
Genetics
Horticulture
Physiology
Production
Weed Science

Dr. Alan A. Atchley
Plant Variety Protection Office
NAL Building, Room 500
10301 Baltimore Blvd.
Beltsville, MD 20705

SUBJECT: PVP Application No. 9500233, Wheat "Kulm"

Dear Dr. Atchley:

Following is the information that you requested (fax 11 January, 1996) so that the examination of "Kulm" wheat may be concluded:

Exhibit E - Statement of the basis of applicant's ownership (revised as follows, February 1996)

"Kulm", the hard red spring wheat cultivar for which Plant Variety Protection is hereby sought was developed by Dr. Richard C. Frohberg, an employee of the North Dakota Agricultural Experiment Station and North Dakota State University. By agreement between employee and the North Dakota Agricultural Experiment Station and North Dakota State University, all ownership rights to Kulm wheat are assigned jointly to the North Dakota Agricultural Experiment Station and to North Dakota State University.

This revised Exhibit E should provide the information for ownership of Kulm wheat.

Sincerely,

Richard C. Frohberg
HRS Wheat Breeder

RCF/ljk

7/16/96
Robert Todd
Director, North Dakota Agricultural Experiment Station

JUL 15 1996
R. Craig Schnell
Dean, Graduate Studies Research, North Dakota State University